Remarks

Claims 1-30 are pending. No amendments are presented with this Response.

Applicants respectfully request reconsideration and allowance of the application in view of the following remarks.

Summary of the Claimed Invention

Claims 1-30 relate to the timing control of steps for spin-coating a developer solution onto a microelectronic substrate. More specifically, the claimed invention helps reduce or eliminate timing delays that occur between the time a spin-coat process event occurs (i.e., a triggering event) and the time the process event is detected and used to initiate a subsequent spin-coat process command (see the specification at, e.g., page 6, lines 23-26). For example, in one sense, the invention relates to the idea that serial process control of developer solution spin coat application can introduce timing delays that significantly affect, e.g., coating uniformity and line width repeatability of developed photoresist film (see the specification at, e.g., page6, lines 15-22). Figure 1 and the related text help illustrate how serial process control can introduce a timing delay between, e.g., developer solution dispense onto a microelectronic substrate and subsequent rotation of the substrate to help distribute the developer solution. That is, the end of developer solution dispense may occur while a serial process controller is sequentially addressing other subroutines in a predetermined, fixed fashion. Accordingly, substrate rotation may not occur until the other subroutines have been addressed which causes delay. Such a delay may be on the order of milliseconds, but when applying a developer solution via spin-coating such delays have been found to significantly affect line width repeatability of developed photoresist film (see the specification at, e.g., page 5, lines 12-15).

A process control system according to the present invention can operate in serial process control mode, but the inventive system can be interrupted upon a trigger event (e.g., end of developer solution dispense) to execute a process command related to application of a developer solution via spin-coating (e.g., rotation of a microelectronic substrate having

developer solution dispensed thereon) (see the specification at, e.g., page 6, line 29 to page 7, line 1).

The invention also relates to the idea that serial process control can allow timing delays to accumulate (see the specification at, e.g., page 5, lines 16-18). For example, Figure 2 shows that steps 1-3 may each have delays associated with each individual step. Because each step is initiated based on the end of the previous step, the delays add together and accumulate (see the specification at, e.g., page 5, line 16 to page 6, line 10).

A process control system according to the present invention can operate in serial process control mode, but can overcome such accumulation of delays by interrupting serial process control to initiate parallel timing of multiple durations between event(s) associated with spin-coat application of developer solution and subsequent command(s) associated with spin-coat application of developer solution (see the specification at, e.g., page 7, lines 6-19).

The Yaegashi et al Reference (U.S. Pat. No. 6,097,459)

The Yaegashi et al. reference is the only reference cited below with respect to the rejection of claims 1-30 under 35 U.S.C. §§ 102 and 103.

The Yaegashi et al. reference generally relates processing resist onto a substrate (see the Abstract and Fig. 3a). The Yaegashi et al. reference specifically relates to controlling an alkaline component in the processing atmosphere of a substrate (see col. 1, line 23 to col. 2, line 60). Yaegashi et al. describe that a cleaning mechanism, including a chemical filter, can be used to filter the alkaline component from process air delivered to certain process areas (see col. 6, lines 57-67). Several processing areas are disclosed as being identified for such a cleaning mechanism including coating section 10, developing section 20, and interface section 30 (see col. 7, lines 20-29 and Fig. 1). However, Yaegashi et al. only broadly mention their developing section 20. Yaegashi et al. do not describe whether a developer solution is applied to a microelectronic substrate via spin-coating or whether serial process control is used to apply a developer solution. Moreover, Yaegashi et al. do not even remotely describe controlling timing delays between developer solution, spin-coating events and subsequent developer solution, spin-coating commands that are associated with serial process control.

Yaegashi et al. indicate that when a particular threshold value of alkaline component is reached, a process can continued or interrupted to change a filter (see col. 7, lines 50-64). By interrupting a process, Yaegashi et al. indicate that eventually all of the processing operations, including developing section 20, are stopped so that a chemical filter can be changed (see col. 9, lines 9-33). After the filter has been replaced, the process operations are restarted (see col. 9, lines 17, 26, and 32). Yaegashi et al. indicate that 3 different approaches can be utilized to eventually stop all the processes depending on how much waste one wants to tolerate (see col. 9, lines 34-48).

Rejection Under 35 U.S.C. § 102

Claims 1-11, 14-18, and 21-30 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Yaegashi et al. (U.S. Pat. No. 6,097,459).

Independent claims 1, 9, 22, and 29, and all rejected dependent claims

Independent claims 1, 9, 22, and 29, and all rejected dependent claims relate to spin-coating a developer solution onto a microelectronic device and include a process control feature that allows a process control system to operate in serial process control mode but specifically interrupts serial process control to execute a process command related to spin-coating a developer solution onto a substrate. Claim 1 is exemplary and is reproduced as follows:

> A method for controlling a process of applying a developer solution onto a substrate using a spin-coating apparatus, the method comprising:
> controlling the process using serial process control wherein the process is controlled by sequentially executing a series of subroutines;
> interrupting the serial process control with an interrupt signal to execute a process command. (Underlining added for emphasis).

The Yaegashi et al. reference does not anticipate claim 1 because it does not, e.g., disclose controlling spin-coat application of a developer solution with serial process control and interrupting the serial process to execute a process command associated with spin-coat application of the developer solution. As discussed above, Yaegashi et al. mention interrupting all processes by stopping all processes, including their developer section, and

changing a chemical filter. Stopping the developer section according to Yaegashi et al. is not the same as interrupting serial process control according to claim 1. According to claim 1, the spin-coat application of a developer solution process is continued because a process command associated therewith is executed subsequent to interruption of serial process control. In other words, changing a filter according to Yaegashi et al. is not a process command associated with applying a developer solution according to claim 1.

Moreover, as discussed above, Yaegashi et al. only broadly mention their developing section and do not disclose whether a developer solution is applied to a microelectronic substrate via spin-coating or whether serial process control is used to apply a developer solution.

Independent claims 10, 27, 28, and 30, and all rejected dependent claims

Independent claims 10, 27, 28, and 30, and all rejected dependent claims relate to spin-coating a developer solution onto a microelectronic device and include a process control feature that executes process commands at durations measured in parallel from an earlier process event or events. Claim 10 is exemplary and is reproduced as follows:

> A method of spin-coating a developing solution onto a microelectronic device, the method comprising executing process commands at durations measured in parallel from an earlier process event.

According to the Office Action, Yaegashi et al. must generate timers if they progressively shut down different process sections until all process sections are stopped to change a filter (see the Office Action at the bridging portion of pages 3 and 4). Based on this, the Office Action concludes that Yaegashi et al. teach executing process commands at times measured in parallel from an earlier process event.

Yaegashi et al. do not necessarily measure durations in parallel according to claim 10 because, e.g., they do not necessarily need timers to progressively shut down process sections. The process control system of Yaegashi et al. could use sensors to determine when particular process sections are ready to shut down. Moreover, Yaegashi et al. do not even remotely disclose using timers, especially in connection with controlling spin-coat

application of a developer solution. As discussed above with respect to claim 1, Yaegashi et al. only broadly mention their developing section and do not even disclose whether a developer solution is applied to a microelectronic substrate via spin-coating.

In addition, claim 10 recites executing "process commands" associated with spin-coating a developing solution onto a microelectronic device. As discussed above with respect to claim 1, stopping the developer section and changing a chemical filter according to Yaegashi et al. is not the same as executing a "process command" associated with spin-coating a developing solution onto a microelectronic device.

Independent claim 21

Independent claim 21 relates to spin-coating a developer solution onto a microelectronic device and features a specific "interrupt service routine" that includes setting two or more timers to run in parallel for durations and interrupting the process control system at the end of each duration to execute a process command associated with spin-coating a developer solution.

As similarly discussed above with respect to claim 1, Yaegashi et al. do not disclose "interrupting" a process control system to execute a process command associated with spin-coating a developer solution. Yaegashi et al. mention "interrupting" their process by stopping all process sections, including their developing section, and changing a filter. This is not the same as "interrupting" according to claim 21 which involves continuing the spin-coat application of a developer solution process and executing a process command associated therewith. Moreover, Yaegashi et al. only broadly mention their developing section and do not even disclose whether a developer solution is applied to a microelectronic substrate via spin-coating.

As similarly discussed above with respect to claim 10, Yaegashi et al. do not necessarily need timers and do not even remotely disclose using timers, especially in connection with controlling spin-coat application of a developer solution.

Accordingly, it is respectfully requested that the rejection of claims 1-11, 14-18, and 21-30 under 35 U.S.C. § 102(e) as being anticipated by Yaegashi et al. be withdrawn.

Rejection Under 35 U.S.C. § 103

Claims 1-30 stand rejected under 35 U.S.C. § 103(a) as being obvious over Yaegashi et al.

Claims 1-11, 14-18, and 21-30

As discussed above in the Summary of Claim Invention and Rejection Under § 102, claims 1-11, 14-18, and 21-30 each recite specific control features that help reduce or eliminate timing delays that occur between the time a developer solution, spin-coat process event occurs and the time the process event is detected and used to initiate a subsequent developer solution, spin-coat process command. As also discussed above in the Rejection Under § 102, claims 1-11, 14-18, and 21-30 are novel over Yaegashi et al.

The Yaegashi et al. reference does not even remotely motivate or suggest the subject matter of claims 1-11, 14-18, and 21-30, because Yaegashi et al. do not even remotely discuss controlling timing delays between developer solution, spin-coating events and subsequent developer solution, spin-coating commands that are associated with serial process control. As discussed above, Yaegashi et al. only broadly mention their developing section and do not even describe whether a developer solution is applied to a microelectronic substrate via spin-coating or whether serial process control is used to apply a developer solution.

Instead, the Yaegashi et al. reference specifically relates to controlling an alkaline component in the processing atmosphere of a substrate (see col. 1, line 23 to col. 2, line 60). Yaegashi et al. describe that a cleaning mechanism, including a chemical filter, can be used to filter the alkaline component from process air delivered to certain process areas.

In addition, the Office Action does not provide any indication of how one of ordinary skill in the art would have been motivated at the time of Applicants' invention to arrive at the subject matter of claims 1-11, 14-18, and 21-30 having only the Yaegashi et al. reference in front of them as guidance when the Yaegashi et al. reference barely discusses their developer section, especially the process control thereof, as noted above.

Indeed, the present rejection of claims 1-11, 14-18, and 21-30 under § 103 is unsupported and cannot stand.

Claims 12, 13, 19, and 20

Claims 12 and 13 depend directly from claim 10 and claims 19 and 20 depend indirectly from claim 10. As discussed above in Rejection Under § 102 and §103, claim 10 is considered patentable over the Yaegashi et al. reference. Likewise, dependent claims 12, 13, 19, and 20, are considered patentable over the Yaegashi et al. reference.

Accordingly, it is respectfully requested that the rejection of claims 1-30 under 35 U.S.C. § 103(a) as being obvious over Yaegashi et al. be withdrawn.

Conclusion

In view of the above remarks, it is respectfully submitted that the claims and the present application are in condition for allowance. Approval of the application and allowance of the claims is earnestly solicited. In the event that a phone conference between the Examiner and the Applicant's undersigned attorney would help resolve any remaining issues in the application, the Examiner is invited to contact said attorney at (651) 275-9831.

Respectfully Submitted,

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